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Review Article

DENTISTRY DURING AND AFTER COVID-19

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ABSTRACT:

The whole world is fighting with the pandemic which has been caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV2). It comes under the category of zoonotic infection, which means the causative organism spreads between animals and human beings. The infection is believed to be originated from bats, pangolins as the intermediate hosts and finally acquired by human beings. Although various measures have been taken globally, but the number of infections seem to rise constantly. The dentists remain at higher risk of getting infected hence this article aims at providing few insights regarding the spread of infection and its containment.

Keywords: COVID-19, SARS CoV-2, infection control, ACE -2.

INTRODUCTION

The novel corona virus which originated in Wuhan, capital of Central China's Hubei province, has spread all over the globe, including India. The novel corona virus is an enveloped single stranded RNA virus which belongs to the family of viruses known as Coronaviridae. Coronaviruses cause infections in birds and mammals. In humans, they cause mild respiratory infections. However, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) are shown to be lethal.The infection caused by corona virus in humans was first identified in 2002 as severe acute respiratory syndrome corona virus (SARS CoV) and Middle East respiratory syndrome corona virus (MERS CoV) in 2012[1]. Due to resemblance of genome sequence of novel corona virus (Covid-19) to beta corona viruses, it has been named as SARS CoV-2.

To prevent the spread of nosocomial and cross infections, the dentists must be aware of symptoms so as to identify a potential carrier or infected person. After identification cases should be referred for appropriate treatment and care. Knowing about the chain of transmission (figure 1) and breaking any one link is important to stop the spread of infection.

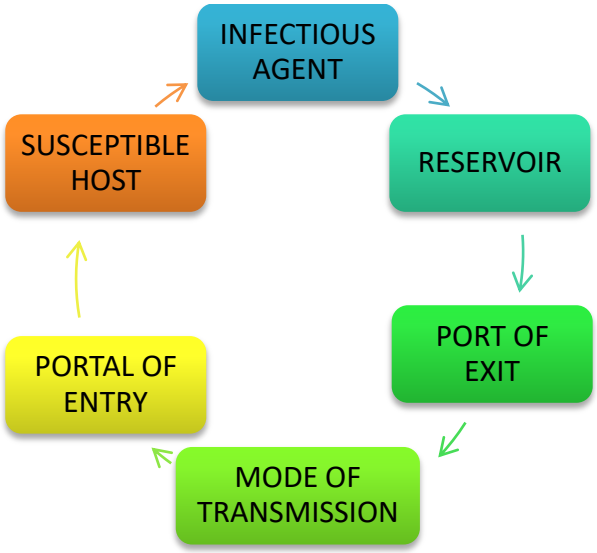

Figure No.1. Chain of transmission

EPIDEMIOLOGY

Based on the evidence, it appears that the infection started from a single animal to human transmission followed by human to human transmission through respiratory droplets and close contact. Transmission through aerosols, fomites and fecal- oral route has also been identified[2]. Vertical transmission (mother to new born child) is yet to be confirmed.

ORAL MUCOSA- POTENTIAL ENTRY ROUTE FOR CORONA VIRUS

Studies suggest that angiotensin converting enzyme-2 (ACE-2) provides the entry point for corona virus to hook into and infect a wide range of human cells. ACE-2 is found to be present in epithelium of mouth, nose and lungs. It is also present in other tissues including heart, blood vessels, kidneys, liver and gastrointestinal tract.

Oral mucosa has been implicated as a potential route of entry for SARS-CoV-2 (Peng et al. 2020).The SARS-CoV-2 cellular entry receptor ACE-2 was found in various oral mucosal tissues, especially in the tongue and floor of the mouth (Xu, Zhong, et al. 2020). ACE-2 positive cells were also detected in buccal and gingival epithelial cells. The presenceof receptors in oral tissues suggests that oral cavity might be the initial site of entry for SARS-CoV-2[3, 4].

SALIVARY GLANDS - POTENTIAL RESERVIORS FOR ASYMPTOMATIC PATIENTS

Yao et al. (2020) [5] analyzed the expression of ACE 2 in human organs and found it to be higher in minor salivary glands than in lungs. According to Wang et al (2004) SARS CoV RNA can be found in saliva before lung lesions appear. For SARS-CoV, the salivary

1. Suspect case [6]:

A. Patients with acute respiratory illness (fever, cough, breathing difficulty), and with no other etiology that fully explains the clinical presentation and at least one of the following:

a) A history of travel to or residence in China in the 14 days prior to symptom onset, or
b) Patient is a health care worker who has been working in an environment where severe acute respiratory infections of unknown etiology are being cared for.
c) An individual who has worked or attended a health care facility where a confirmed case of 2019-nCoV was admitted in the last 14 days.
d) Close contact with a confirmed case of 2019-nCoV in the 14 days prior to illness onset, or

B. A suspect case for whom testing for 2019-nCoV did not yield conclusion result.

2. Confirmed case [6]: A person with laboratory confirmation of 2019-nCoV infection, irrespective of clinical signs and symptoms is considered as confirmed case.

gland could be a major source of the virus in saliva (Liu et al. 2011) and saliva samples can also cultivate the live virus as suggested by To et al. (2020) [5]. These studies suggest that COVID-19 transmitted by asymptomatic infection may originate from infected saliva. Thus salivary glands should be considered as potential reservoir of infection.

SOURCES OF INFECTION

The infection can be acquired from a confirmed positive subject who is showing symptoms of infection. Transmission could be through respiratory droplets, fomites or close contact. However, patients in their incubation period and asymptomatic carriers can also transmit infection to healthy individuals. The incubation period identified is ranging from 14-21 days in various studies. With increasing number of patients without symptoms it has become difficult to identify whether the person is asymptomatic carrier or healthy. For the safety of own self and the dental staff each and every patient should be regarded as a suspected COVID patient.

CLINICAL SYMPTOMS

Some studies suggest dry mouth, loss of taste and smell might be the only symptoms in few cases or these might be the early symptoms [4] even before fever, dry cough, sore throat, muscle weakness, headache, confusion, diarrhea and vomiting during initial days of infection. Proper diagnosis and treatment at this stage has cured majority of the patients. In advanced cases, shortness of breath along with chest CT showing ground glass opacity of both the lungs suggesting pneumonia has been seen. Patients with severe infection in intensive care units have shown acute respiratory distress, arrhythmias and shock along with multi organ system failure leading to death [2]. Majority of such cases had underlying co-morbid conditions.

DIAGNOSIS AND TREATMENT PLANNING IN DENTAL SETUP SHOULD BE BASED ON-

1. **Epidemiological information** acquired from patient (residence in affected areas or travel to high risk zones)

2. **Clinical symptoms** based on thorough history (if symptoms present, how many days have elapsed since onset of symptoms)
3. **Radiographic imaging** (chest CT, if required)
4. **Laboratory test**- reverse transcriptase polymerase chain reaction test (RT-PCR) for confirmation [2].

IMPORTANCE OF INFECTION CONTROL IN DENTAL SET UP

Dentistry involves face-to-face communication with patients, and frequent exposure to saliva, blood, and the handling of sharp instruments.

1. **Risk of nosocomial infection:** dental procedures like tooth preparation, endodontic access opening and use of ultrasonic instruments generate huge amount of **aerosols**. Coughing or sneezing in the clinics produces droplets. These aerosols and droplets remain in the environment for a long period of time (2hrs-3 days as suggested by different studies) which might be inhaled by the dental staff or patients. Transmission through **fomites** occur as these droplets rest on surfaces like dental chairs, micro motors, x- ray machines, light and fan switches, door handles, taps etc. and later touched and carried by people. Procedures like biomechanical preparation of tooth, impression making and tooth extractions have risk of contamination through splash generation.
2. **Risk of cross infection:**infection might be transmitted to a healthy clinician from an infected patient or vice versa. Infection can be transmitted from an infected dental patient to a healthy dental patient through contaminated instruments or surfaces.

TABLE NO. 1. DENTAL PROCEDURES FOR ASYMPTOMATIC DURING COVID-19 PANDEMIC

Urgent procedures should be undertaken only after tele- consultation, tele-triage, consent, and through pre-fixed appointment only.

	PROCEDURES/ CLINICAL CONDITIONS	RISK
EMERGENCY DENTAL PROCEDURES	Fast spreading infections of facial spaces/Ludwig Angina/Acute cellulitis of dental origin/Acute Trismus. Should connect with hospital settings emergency settings immediately.	Very high
	Uncontrolled bleeding of dental origin**.** Should connect with hospital settings emergency settings to rule out other causes.	Very high
	Severe uncontrolled dental pain, not responding to routine measures.	High
	Trauma involving the face or facial bones.	Very High

	Radiographs like PNS, OPG, CBCT in facial trauma and in medico-legal situations	High
URGENT DENTAL PROCEDURES	**Children and adolescents**	
	Acute Pulpitis	High
	Dental abscess	Very High
	Dentoalveolar trauma	High
	Pain of cavitation needing temporisation	High
	Unavoidable Dental Extractions	Very High
	Orthodontic procedures **(** see the section on adults**)**	Moderate
	Adults and Geriatric	
	Dental pain of pulpal origin not controlled by Advice, Analgesics, Antibiotics **(**AAA**)**	High
	Acute dental abscess of pulpal / periodontal/ endo-perio origin/ Vertical split of teeth	High
	Completion of ongoing root canal treatment **(**RCT**)**	High
	Temporization of cavitation in teeth which are approximating pulp but do not need pulp therapy	High
	Broken restoration/ fixed prosthesis causing sensitivity of vital teeth/ endangering to pulpitis /significant difficulty in mastication	High
	Unavoidable Dental Extractions / Post extraction complications	Very High
	Already prepared teeth/ implant abutments to receive crowns	High
	Peri-implant infections endangering stability	High
	Pericornitis / Operculetomy	High/Moderate
	Oral mucosal lesions requiring biopsy	High
	Long-standing cysts and tumours of the jaw with abrupt changes	High

	Sharp teeth /Trigeminal neuralgia	Moderate
	Orthodontic wire or appliances, piercing or impinging on the oral mucosa.	Moderate
	Orthodontic treatment causing Iatrogenic effects	Moderate
	Delivery of clear aligners	Moderate
	Patients on skeletal anchorage	Moderate
	Repair of Broken complete dentures	High
	Implant prosthesis related issues	High
	Oral mucosal infections such as candidiasis	High
	Oral mucosal lesions showing sudden changes or suspicion of causing severe problems,/ oral cancer requiring biopsy	High
	Patients with medical conditions	
	Diabetes patients requiring treatment for periodontal conditions	High
	Dental treatment for patients requiring cardiac surgery	Very high
	Hospitalized patients requiring dental care for acute problems	Very high
	Patients requiring dental treatment for radiotherapy /organ transplantation	Very high

INFECTION CONTROL IN THREE PHASES (MoHFW)

a) **PREPARATORY PHASE**
b) **IMPLEMENTATION PHASE**
c) **FOLLOW UP PHASE**

1. PHASE I: PREPARATORY PHASE

a. Modifications in Dental Clinics

Ventilation and air quality management in stand-alone dental clinics.

Maintain air circulation with natural air through a frequent opening of windows and using an independent exhaust blower to extract the room air into the atmosphere.

Avoid the use of a ceiling fan while performing procedure.

Place a table fan behind the operator and let the airflow towards the patient. A strong

exhaust fan should be located to create a unidirectional flow of air away from the patient.
The window air condition system/split AC should be frequently serviced and filters should be cleaned.
Use of indoor portable air cleaning system equipped with HEPA filter and UV light may be used.
In central AC buildings, on-recirculatory system: Return air vents in the patient area should be blocked off to temporarily stop air circulation provided. Fresh air should be allowed into rooms by opening doors and windows slightly.

b. Entrance and reception desk
Display visual alerts at the entrance of the clinics (e.g., waiting areas or elevators) about respiratory hygiene, cough etiquette, social distancing and disposal of contaminated items in trash cans.
Install glass or plastic barrier at the reception desk.
Ensure availability of sufficient three-layer masks, sanitizers and paper tissue at the registration desk, as well as nearby hand hygiene stations.
Distant waiting chairs, preferably a meter apart.
All areas should be free of all fomite such as magazines, toys etc.
Cashless/contactless payment methods should be preferred.
A bin with lid should be provided at triage where patients can discard used masks and paper tissues.

c. Changing Rooms
Changing room should be available for staff and all workers to wear surgical top and pajamas and clinic shoes.

d. Dedicated area for donning (wearing) and doffing (removal) of PPE should be provided:
Personal clothes should not be worn in clinics. Scrubs along with PPE should to be acquired before entering clinics. After clinical hours, PPE should be removed and disposed and scrubs should be changed in the dedicated area.

e. Dedicated area for sterilization:
A dedicated and trained person should be available to undertake transport, cleaning, drying, packing, sterilization, storage and testing the quality of sterilization as per the standard guidelines and manufacturer's instructions.
Sufficient and dedicated space for storage of additional items of PPE and sterilization and disinfection instruments and chemicals must be ensured.

f. Washrooms
Sensor taps or taps with elbow handles
Do not use towels, Paper towels should be are preferred

g. Equipment and instrumentation
Fumigation systems for clinics and laboratory.
High volume extra oral suction should be used.

The indoor air cleaning system needs to be installed.
The dental chair water lines should be equipped with anti- retraction valves.
Hand pieces with anti-retraction valves only should be used.
Chemicals required for disinfection e.g. Sodium hypochlorite.
Acquire appropriate PPE and ensure it is accessible to HCW.
Maintain a supply of all consumables related to PPE, sterilization and disinfection.

h. Training of Healthcare Workers (HCWs)
Train administrative personnel working in the reception of patients on hand hygiene, social distancing, use of facemask, for them and incoming patients.
Educate all HCW on proper selection and use of PPE. They may require psychological support and morale-boosting to maintain their level of confidence and strict adherence of guidelines.
Staff should rotate more frequently, preferably, should avoid long working hours and ensure proper nutrition and sleep.
All staff and dentist must use surgical attire in the dental office, and all personal clothing should be avoided.

i. Environment and Surface Disinfection:
Floors: 2 Step Cleaning Procedure-first with **Detergent** and then with **freshly prepared 1% sodium hypochlorite** with a contact time of **10 minutes.** Mop the floor should start at the far corner of the room and worked towards the door.
Frequency: after any patient/ major splash or two hourly.

j. Rest of the surfaces: Freshly prepared 1% sodium hypochlorite (Contact Time: 10 minutes). Damp dusting should be done in straight lines that overlap one another. Frequency: before starting daily work, after every procedure and after finishing daily work.

k. Delicate Electronic equipment: should be wiped with alcohol-based rub/spirit (60-90% alcohol) swab before each patient contact.

2. PHASE II- IMPLEMENTATION PHASE
a.Tele screening and triage:
Triage is the process of determining priority of patient's treatment by severity of their condition. Screening through telephone can be done by asking the patient about recent history of fever along with cough, residence in high risk zone and close contact with a confirmed Covid- 19 case in last 14 days. Positive answer for even one question should raise an alarm and an elected procedure should be delayed for at least 3 weeks except for dental emergencies. Fever due to dental ailment (abscess, oral space infections or severe peri-coronitis) should be ruled out by asking leading questions like presence or absence of gingival or oro-facial swelling.
Only pre appointed patients should be allowed for treatment.A COVID- 19 screening questionnaire with assessment of a true emergency questionnaire along with a consent form should be completed by patients.

b. Managing patients at clinic:

Temperature measurement should be done with an infrared thermal scanner or non-contact thermometer for each patient.

TABLE NO. 2. PROCEDURES AND RECOMMENDED PPE

Procedure	Recommended PPE
Examination only	Triple layered surgical mask, protective eyewear/face shield and gloves.
For moderate risk procedures	All PPE except the coveralls can be substituted with surgical gowns
For high and very risk procedures	N-95 face mask, protective eyewear/face shields, gloves along with coveralls and shoe covers

c. Patient discharge protocol

The patient drape should be removed by the assistant, and the patient is asked to perform hand wash and guided out of the clinic.

The procedures and prescription recording should be done only after doffing the PPE.

Patient should be provided with review /follow up instructions.

d. Patient turn around and disinfection protocol

The assistant should collect all hand instruments immediately after the patient leaves, rinse them in running water to remove organic matter and as per standard sterilization protocol.

All 3 in 1 syringe, water outlets, hand piece water pipelines, etc. should be flushed with the disinfectant solution for 30-40 seconds.

Water containers should be removed and washed thoroughly and disinfected with 1% sodium hypochlorite using clean cotton/ gauge piece and then filling with fresh 0.01% sodium hypochlorite solution and attach back to the dental chair.

Finally dental Chair should be disinfected along with all the auxiliary parts within 3 feet of distance using 1% sodium hypochlorite and cleaned and sterilized cotton/gauge piece using inner to outer surface approach and leave for drying**.** New cotton/ gauge piece should be used for every surface.

Hand pieces should be cleaned using a hand piece cleaning solution to remove debris, followed by packing in the autoclave pouches for autoclaving. Record should be maintained for the same.

Impressions should be thoroughly disinfected before pouring or sending to the laboratory using an appropriate disinfectant.

e. Pharmacologic Management:

In suspected or confirmed cases of COVID- 19 infections requiring urgent dental care for conditions such as tooth pain and/or swelling, antibiotics and/or analgesics can be given. This approach may offer symptomatic relief and will provide dentists sufficient time to either refer the patient to a specialist or deliver dental care with all appropriate measures [1].

3. PHASE III - PATIENT FOLLOW-UP AND REVIEW

The patient should be contacted over telephone in 24 hours and in a week's time to know if patient has developed any symptoms that should warn the dental staff to undertake appropriate actions. Patient should be advised to inform back to the dental clinic should there be any adverse symptoms.

Advice to patients

Patient should be advised to wear masks or cover their face while maintaining adequate distance from other patients and dental staff. Touching any surface and face should be discouraged. They should be instructed to wait outside the clinical premises if possible (e.g. in their car). If feasible the patient should come alone to the clinics. Elderly patients can be accompanied with one person to avoid crowding.

RECOMMENDATIONS FOR DENTISTS

Standard precautions must be followed for all patients at all the times. The elements of standard precautions are[7]:

1. Perform hand hygiene

Washing hands properly from time to time should be encouraged.

Before and after treating each patient for 40-60 seconds with soap and water. Alcohol based hand rub (at least 60%) can be used for 20-30 seconds where running water is not available.

When hands are visibly soiled use water and soap.

After touching equipments, materials, used instruments and other objects that are likely to be contaminated by saliva, blood or respiratory secretions.

2. Perform respiratory hygiene (cough etiquette)

All persons with signs and symptoms of a respiratory infection (regardless of presumed cause) must be instructed to follow respiratory hygiene/cough etiquette.

Nose and mouth should be covered with tissue when coughing or sneezing.

Tissues should be disposed in the nearest waste receptacle immediately after use.

Hand hygiene should be performed after contact with respiratory secretions and contaminated objects/material.

In absence of tissue/handkerchief patient and dental staff should to be instructed to cover their nose and mouth with arm or with elbows flexed during coughing or sneezing.

Patients and staff should not spit here and there.

3. Personal protective equipment according to the risk

Personal protective equipment (PPE) refers to wearable equipment that is designed to protect from exposure to or contact with infectious agents. It effectively covers personal clothing and skin likely to be soiled with blood, saliva, or other potentially infectious materials.

These include protective clothing (e.g., reusable or disposable gown, jacket or coat) face masks, protective eye wear, face shields, gloves and shoe covers **(Table No. 3).**

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TABLE NO.3. PERSONAL PROTECTIVE EQUIPMENT(PPE)

Adapted from guidelines for PPE by Ministry of Health and Family Welfare.Novel Coronavirus Disease 2019 (COVID-19): Guidelines on rational use of Personal Protective Equipment Annexure A.

GOWN	**SURGICAL MASK**	**N-95 RESPIRATOR**
		
Should be impermeable to blood and body fluids. Single use. Light colors are preferable to better detect possible contamination. Thumb/finger loops to anchor sleeves in place. Quality compliant with following standard: Meets or exceeds ISO 16603 class 3 exposure pressure, or equivalent	Three layered medical mask of non-woven material with nose piece, having filter efficiency of 99% for 3 micron particle size. a. ISI specifications or equivalent	Shape should not collapse easily High filtration efficiency. Good breathability, with expiratory valve. Quality compliant with standards for medical N95 respirator: a. NIOSH N95, EN 149 FFP2, or equivalent b. Fluid resistance: minimum 80 mmHg pressure based on ASTM F1862, ISO 22609, or equivalent Quality compliant with standards for particulate respirator that can be worn with full face shield
GOGGLES	**GLOVES**	**FACE SHIELD**
		

With transparent glasses, zero power, well fitting, covered from all sides with elastic band/or adjustable holder. Good seal with the skin of the face. Flexible frame to easily fit all face contours without too much pressure. Covers the eyes and the surrounding areas and accommodates for prescription glasses. Fog and scratch resistant. Adjustable band to secure firmly so as not to become loose during clinical activity. Indirect venting to reduce fogging. May be re-usable (provided appropriate arrangements for decontamination are in place) or disposable. Quality compliant with the below standards, or equivalent: a. EU standard directive 86/686/EEC, EN 166/2002 b. ANSI/SEA Z87.1-2010	Nitrile Non-sterile Powder free Outer gloves preferably reach mid-forearm (minimum 280mm total length) Different sizes (6.5 & 7) Quality compliant with the below standards, or equivalent: 1. EU standard directive 93/42/EEC Class I, EN 455 2. EU standard directive 89/686/EEC Category Ill, EN 374 3. ANSI/SEA 105-2011 4. ASTM D6319-10	Made of clear plastic and provides good visibility to both the wearer and the patient. Adjustable band to attach firmly around the head and fit snuggly against the forehead. Fog resistant (preferable). Completely covers the sides and length of the face. May be re-usable (made of material which can be cleaned and disinfected) or disposable. Quality compliant with the below standards, or equivalent: a. EU standard directive 86/686/EEC, EN 166/2002 b. ANSI/SEA Z87.1-2010

HEAD CAP	**SHOE COVERS**
	
Coveralls usually cover the head. Those using gowns should use a head cover that covers the head and neck while providing clinical care for patients. Hair and hair extensions should fit inside the head cover.	Shoe covers should be made up of impermeable fabric to be used over shoes to facilitate personal protection and decontamination. Should cover the entire shoe and reach above ankles

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Proper donning and doffing of PPE is of utmost importance. **(figure 2 and 3)**Adapted from: Centers for Disease Control and Prevention recommendations for putting on and removing personal protective equipment for treating COVID-19 patients.

TABLE NO. 4.DONNING OF PPE

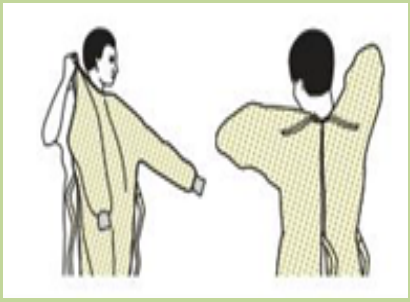
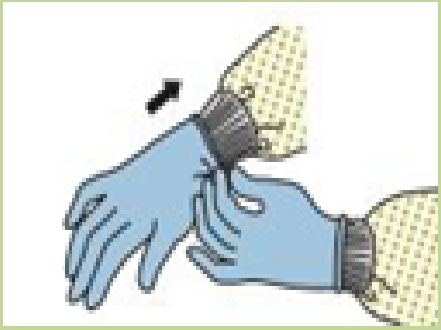
1. GOWN -Fully cover torso from neck to knees, arms to wrists, and wrap around the back. -Fasten in back of neck and waist.	
2. MASK OR RESPIRATOR: -Secure ties or elastic band at the middle of head and neck. -Fit flexible band to nose bridge. -Fit snug to face and below chin. -Check fit for respirator.	
3. GOGGLES OR FACE SHIELD - Place over face and eyes and adjust to fit.	
4. GLOVES -Extend to cover wrist of isolation gown	

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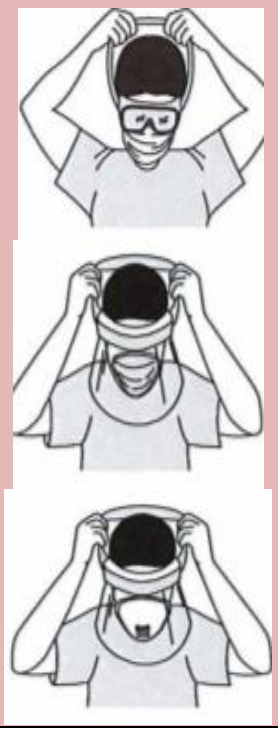
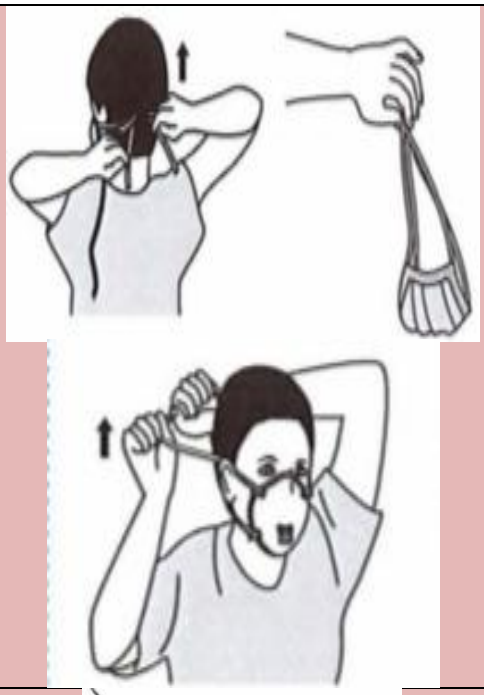
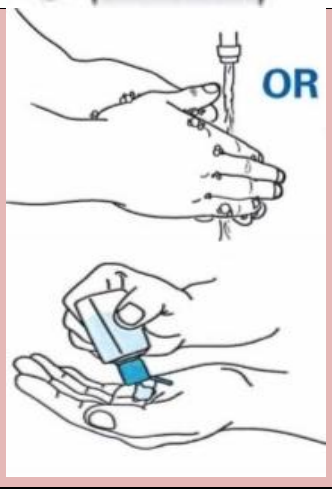
TABLE NO. 5. DOFFING OF PPE

1. **GOWN AND GLOVES** -Gown front and sleeves and the outside of gloves are contaminated. -If hands get contaminated during gown or gown removal, immediately wash hands or use an alcohol based hand sanitizer. -Grasp the gown in the front and pull away from body so that the tie breaks, touching outside of gown only with gloved hands. -While removing the gown, fold or roll the gown inside-out into a bundle.	
2. **GOGGLES OR FACE SHIELD** -outside of goggles or face shield are contaminated. -if hands get contaminated during goggle or face shield removed, immediately wash hands or use an alcohol based hand sanitizer. -remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield. -if the item is reusable, place in designated receptacale for reprocessing. Otherwise, discard in a waste container.	

3. **MASK OR RESPIRATOR** -front of the mask is contaminated- DO NOT TOUCH. -if hands get contaminated during mask/respirator removal, immediately wash hands or use an alcohol based hand sanitizer. -grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front. -discard in a waste container.	
4. **WASH HANDS** or use an **ALCOHOL BASED HAND SANITIZER** immediately after removing all ppe.	

4. Safe injection practices, sharps management and injury prevention.
Always use aseptic technique when preparing and delivering injections. Use a new, sterile, single-use needle and sterile, for every patient and safely disposing them in designated closed, puncture-resistant containers.

5. Safe handling, cleaning and disinfection of patient care equipment.
Dental chair, x-ray machine, microscopes, CBCT machine, articulators, etc. should be cleaned with a disinfectant as suggested by manufacturer. In absence of manufacturer's instruction ethyl alcohol or isopropyl alcohol (60-90%v/v) can be used.
Chemical disinfectants can be classified into-
A)High-level disinfectants: are capable of killing bacterial spores and all other microbial forms. E.g. ethylene oxide gas or glutaraldehyde solutions.
B)Intermediate level disinfectants: they can destroy microbes like tubercle bacilli, but they do not inactivate spores. E.g. formaldehyde, alcohols, chlorine compounds, iodophors and phenolic

compounds.

C) Low-level disinfectants: these chemical agents have narrow antibacterial activity. E.g. quaternary ammonium compounds, simple phenols, and detergents, which are unacceptable for impressions disinfection

TABLE NO. 6. SPAULDING CLASSIFICATION OF EQUIPMENT DECONTAMINATION:

CRITICAL	Instruments which penetrate tissue or touch bone. e.g. scalpels, scalers, burs, forceps, elevator etc. These must be sterilized by heat or chemical. This is done to kill all microorganisms.
SEMI-CRITICAL	These instruments touch mucous membrane but don't penetrate. e.g., mouth mirror, probes, tweezers, impression trays, amalgam carrier, handpiece etc. These should be subjected to high level disinfection by heat or chemicals
NON CRITICAL	These instruments only contact with intact skin, e.g., head light, dental chair, X-ray head/cone, blood pressure cuff, facebow etc. These should be subjected to low- intermediate level disinfection.

It has been suggested that SARS-CoV-2 which is an enveloped is easy to kill. The order of microorganism to resist the disinfectants/sterilants is as follows:

Prions→Spores→Mycobacterium (Tb)→non enveloped viruses→fungi →vegetative spores→enveloped viruses[8]

Environmental surfaces- cleaned in two stages*: Pre-cleaning stage*- disinfectant is sprayed and wiped with a clean cloth. *Disinfection stage*- the disinfectant is sprayed again and left for recommended time followed by wiping with a fresh paper towel [9].

Barrier technique should be followed where in thin plastic covers or aluminum foil can be used to cover dental chair's light handle, arms, head rest, air rotor hand piece and hose, Micromotor hand piece and hose, air/water syringe and hose, dental x ray unit and cone, bite block of OPG machine, intra oral digital scanners, RVG and sensor, apex locators and endo motors [9].

6.Environmental cleaning

At room temperature corona virus might remain infectious from 2 h up to 9 days, and persists better at 50% compared with 30% relative humidity [1]. Thus, keeping a clean and dry environment in the dental office would help decreasing the viral load in the clinical environment. 15-20 minutes gap should be given in between patients for cleaning and disinfection of the dental chair and surroundings.

All surfaces and items touched by hands coated with saliva or blood should be scrubbed before seating the patient.

7. Safe handling and cleaning of soiled linen

Must be handled with care and disposed off in appropriate bins.

8. Waste management.

As precaution double layered bags should be used to collect Covid related waste to ensure adequate strength and no leaks. It should be labeled as "COVID-19 WASTE" and kept separately in a temporary storage room prior to handling to authorized staff of common bio medical waste treatment and disposal facility (CBWTF) [10]. General waste not having any contamination should be disposed as solid waste as per Biomedical waste management 2016 **(Table 2).**

TABLE NO. 7. BIOMEDICAL WASTE MANAGEMENT

CATEGORY	TYPE OF CONTAINER	TYPE OF WASTE	TREATMENT DISPOSAL OPTIONS
YELLOW	Non chlorinated color coded bags in colored bins Separate collection system leading effluent treatment system	**-Used masks(including triple layered & N95), head cover/cap, shoe cover, disposable linen gown, non-plastic or semi-plastic coverall[9]** -Human anatomical waste -Animal anatomical waste -Soiled waste -Expired or discarded medicine Micro, bitotech& clinical lab waste Chemical waste	Incineration / deep burial
RED	Non chlorinated plastic bags in colored bins	**-Used goggles, face-shields, splash proof apron, plastic coverall, Hazmet suit[9]** -Contaminated waste (recyclable), tubing, bottles, urine bags, syringes (without needles) and gloves	Auto/micro/hydro and then sent to recycling. Not to be sent to lands fill.
WHITE	(Translucent) puncture, leak, tamper proof containers	Waste sharps including metal	Auto or dry heat sterilization followed by shredding or mutilation or encapsulation
BLUE	Cardboard boxes with blue colored marking	Glassware	Disinfection or auto/ micro/hydro and then sent for recycling

TABLE NO. 8. SPECIAL CONSIDERATIONS

Pre treatment Oral rinses	A study showed that the use of pre-procedural mouth rinse, including **chlorhexidine** (CHX), **essential oils**, and **cetyl-pyridinium chloride** (CPC), resulted in a mean reduction of 68.4% colony-forming units in dental aerosol (Marui et al. 2019) [10] Oral rinses for one minute with **povidone-iodine (0.2%)** to reduce the viral load in oral cavity (povidone- iodine rinses have shown to be effective against SARS CoV and MERS CoV [2, 4]. **1% hydrogen peroxide** has been suggested by American dental association (ADA) prior to commencement of any procedure.
Use of disposable items	Single use mouth mirrors, probe, disposable impression trays can used for making impressions.
During procedure	**Four handed dentistry** is said to be effective in controlling infection as the procedure can be done by the dentist and isolation, fluid control, passing of instruments and materials can be done by an attendant. Use of **rubber dam** should be encouraged for tooth preparations. **High speed hand piece without anti retraction valve** might aspirate and release water and oral fluids while using. Peng et al. (2020) stated that anti-retraction high-speed dental hand piece can significantly reduce the backflow of oral bacteria and viruses into the tubes of the hand piece and dental unit[3]. Impression must be made in right sized trays so that chances of gag or cough reflex are reduced. **Ultrasonic scaling should be replaced with hand scaling**. **Use of high speed air rotors should be avoided**. Caries excavation can be done with micro motor. Endodontic therapy can be done with **chemo-mechanical means** (use of pulp de-vitalizer).
Extra oral radiography	Extra oral radiography like Orthopantomogram (OPG), cone bean computed tomography (CBCT**) to prevent gag and cough**. If intraoral imaging is necessary, appropriate measures should be taken to avoid infection.
For suspected/ Confirmed cases	Patients requiring urgent dental treatment, **highest level of personal protection** should be implemented. WHO recommends the use of a **negative pressure room**. Mechanical ventilation should commence before treating the next patient.
Filtration of contaminated air	Installing **high efficiency particulate air (HEPA) filtration** equipment is recommended which is said to remove at least 99.95% of particles whose diameter is equal to 0.3µm. The diameter of droplets (>5µm) and aerosol (<5µm) are said to be captured by HEPA filters [10].

PROSTHODONTIC CONSIDERATIONS

- No specific guidelines are provided for disinfection of impressions against corona virus. Routinely, manufacturer's instructions or following recommendations are usually followed.

TABLE NO. 9. IMPRESSION MATERIALS AND DISINFECTING AGENTS RECOMMENDED [11]

IMPRESSION MATERIALS	DISINFECTANT AGENT	DURATION
Alginate	Iodophors and diluted sodium hypochlorite	10 minutes
Compound	Iodophors and diluted sodium hypochlorite	10 minutes
Polyether	Iodophors and diluted sodium hypochlorite, complex phenolics	10 minutes
Polysulphide	Iodophors and diluted sodium hypochlorite, complex phenolics	10 minutes
Silicone	Iodophors and diluted sodium hypochlorite, complex phenolics	10 minutes
Agar	Iodophors and diluted sodium hypochlorite	10 minutes
Zinc-oxide eugenol	Iodophors	10 minutes

- Immersion type of disinfection may be preferred over spray.
- Go for digital impressions wherever possible.
- Disinfect burs/ equipments and hand piece after every patient.
- Handle all the lab work with **gloves**.
- Use **face masks along with face shield for acrylic trimming.**
- Polishing wheels, slurry for acrylic polishing should be changed and disinfected regularly.
- All the **surfaces** in lab should be disinfected before leaving**.**
- Use of **0.1% sodium hypochlorite or 70% isopropyl alcohol** for the disinfection of all surfaces.

DISCUSSION

Dental fraternity is among the group of people at highest risk of getting corona infection. The current situation questions our preparedness for any pandemic. Dentists play a crucial role in education of the patients and prevention of infections but the pandemic has put dentists on back foot.

On resuming the work at clinics, every case should be considered potentially infected with n-CoV and all the necessary precautions should be taken at all times. It is also the duty of health care professionals to maintain high standards of infection control and protect the public.

The social distancing norm should be followed and encouraged at all time. Use of rubber dam and high speed evacuation system had been advised. Aerosol generating procedures

should be done in negative air pressure chambers or should be kept in the last working hours where negative air chambers are not available. Frequent disinfection of surfaces that are touched regularly is mandatory. Appropriate PPE usage along with proper disposal is of utmost importance in the present scenario.

SUMMARY AND CONCLUSION

At present there is increased anxiety and fear reported among dental professionals due to falling under high risk zone. Absence of any approved treatment and no vaccine further enhances the anxiety upon thought of getting infected.

Not being able to work for an indefinite period has also added to financial and psychological insecurity. Those who are working have additional expenses for maintenance of clinics, acquiring PPE, installation of HEPA filters, enhanced sterilization and disinfection protocols and incorporation of negative air pressure chambers. There has been a surge in price of gloves, masks, alcohol based sanitizers and other PPE due to increased demand and scarcity of the same. All this has added to the financial burden of the dentist. Another fear is of carrying infection to their families and cost incurred during treatment. Health facilities may not be sponsored globally and can add to financial crisis.

Amidst this scenario it is important for us to take care of ourselves and co-workers. A platform for psychological help should be formed. Importance of maintaining social distance should be encouraged among dental staff and patients at all times.

Dental staff should be advised to perform respiratory exercises. Emphasis should be placed on improving overall health and immunity. The dental personals should be advised to keep a check on their symptoms and measure their temperature before entering clinics. A sick person should not be allowed to work and made to rest.

With due course of time, corona virus might become less virulent and pathogenic as stated by authorities. Till then, dental professionals are advised to keep themselves updated with the latest guidelines provided by the government and follow the same.

Links for some important topics:

For sterilization protocol (CDC guidelines):
https://www.cdc.gov/mmwr/PDF/rr/rr5217.pdf.

Testing for COVID-19 before resuming work in clinics: https://www.icmr.gov.in/pdf/covid/strategy/Strategey_for_COVID19_Test_v4_09042020.pdf

Hydroxychloroquine Prophylaxis:
https://www.mohfw.gov.in/pdf/AdvisoryontheuseofHydroxychloroquinasprophylaxisforSARSCoV2infection.pdf,https://www.icmr.gov.in/pdf/covid/techdoc/HCQ_Recommendation_22March_final_MM_V2.pdf

Hand hygiene as per the WHO guidelines:
https://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf

Donning and Doffing of PPE:
a. https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html
b. https://covid.aiims.edu/personal-protective-equipment-covid-19-preparedness/

Use of N -95 masks/Guidelines for extended use link:
a. https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html/
b. https://covid.aiims.edu/using-personal-protection-n95-masks-given-to-health-care-workers-at-aiims

Standard Precautions: https://www.cdc.gov/oralhealth/infectioncontrol/summary-infection-prevention-practices/standard-precautions.html/

Biomedical waste management: Biomedical waste management area is to be equipped with required bins as per Government of India guidelines**.** **(**https://www.cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID.pdf)

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